Mark Scheme 4725
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Mark Total

1.	(i) $2 + 16i - i - 8i^2$ $10 + 15i$ (ii) $\frac{1}{5}(10 + 15i)$ or $2 + 3i$	M1 A1 M1 A1 A1ft	2 3 **5**	Attempt to multiply correctly Obtain correct answer Multiply numerator & denominator by conjugate Obtain denominator 5 Their part (i) or $10 + 15i$ derived again / 5
2.	$1^2 = \frac{1}{6} \times 1 \times 2 \times 3$ $\frac{1}{6}n(n + 1)(2n + 1) + (n + 1)^2$ $\frac{1}{6}(n + 1)(n + 2)\{2(n + 1) + 1\}$	B1 M1 DM1 A1 A1	5 **5**	Show result true for n = 1or 2 Add next term to given sum formula, any letter OK Attempt to factorise or expand and simplify Correct expression obtained Specific statement of induction conclusion, with no errors seen
3.	(i) $2\begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix} - 1\begin{bmatrix} 1 & 1 \\ 1 & 3 \end{bmatrix} + 3\begin{bmatrix} 1 & 2 \\ 1 & 1 \end{bmatrix}$ 2 x 5 – 1 x 2 +3 x -1 5 (ii)	M1 A1 A1 B1ft	3 1 **4**	Show correct expansion process, allow sign slips Obtain correct (unsimplified) expression Obtain correct answer State that **M** is non-singular as det **M** non-zero, ft their determinant
4.	$u^2 + 4u + 4$ $u^3 + 6u^2 + 12u + 8$ $u = \sqrt[3]{5}$ $x = 2 + \sqrt[3]{5}$	B1 M1 A1 A1ft A1ft	5 **5**	$u + 2$ squared and cubed correctly Substitute these and attempt to simplify Obtain $u^3 - 5 = 0$ or equivalent Correct solution to their equation Obtain 2 + their answer [Decimals score 0/2 of final A marks]

5.	$8\Sigma r^3 - 6\Sigma r^2 + 2\Sigma r$ $8\Sigma r^3 = 2n^2(n+1)^2$ $6\Sigma r^2 = n(n+1)(2n+1)$ $2\Sigma r = n(n+1)$ $2n^3(n+1)$ **AG**	M1 A1 A1 A1 M1 A1	 6 **6**	Consider the sum of three separate terms Correct formula stated or used a.e.f. Correct formula stated or used a.e.f. Correct term seen Attempt to factorise or expand and simplify Obtain given answer correctly

6.	(i) $\frac{1}{2}\begin{pmatrix} 8 & -2 \\ -3 & 1 \end{pmatrix}$ (ii) Either $\frac{1}{2}\begin{pmatrix} 14 & 2 \\ -5 & 0 \end{pmatrix}$ Or $\frac{1}{5}\begin{pmatrix} 3 & -1 \\ -1 & 2 \end{pmatrix}$ $\mathbf{B} = \mathbf{A}^{-1}\mathbf{C}$ $\mathbf{B} = \frac{1}{5}\begin{pmatrix} 0 & -2 \\ 5 & 14 \end{pmatrix}$ $\frac{1}{2}\begin{pmatrix} 14 & 2 \\ -5 & 0 \end{pmatrix}$ Or $\mathbf{AB} = \begin{pmatrix} 2a+c & 2b+d \\ a+3c & b+3d \end{pmatrix}$ $a = 0, c = 1, b = -0.4, d = 2.8$ $\frac{1}{2}\begin{pmatrix} 14 & 2 \\ -5 & 0 \end{pmatrix}$	B1 B1 B1 M1A1 M1 A1ft B1 M1 M1 A1ft A1 B1 M1 A1A1 A1	 2 5 **7**	Transpose leading diagonal and negate other diagonal Divide by determinant State or imply $(\mathbf{AB})^{-1} = \mathbf{B}^{-1}\mathbf{A}^{-1}$ Use this result and obtain $\mathbf{B}^{-1} = \mathbf{C}^{-1}\mathbf{A}$, or equivalent matrix algebra Matrix multn., two elements correct, for any pair All elements correct ft their (i) Find $\mathbf{A}^{-1}$ Premultiply by $\mathbf{A}^{-1}$ stated or implied Matrix multn. Two elements correct All elements correct Correct $\mathbf{B}^{-1}$ Find **AB** Solve one pair of simultaneous equations Each pair of answers Correct $\mathbf{B}^{-1}$

7.	(a) (i) $\sqrt{13}$	B1	1	Obtain correct answer, decimals OK
	(ii)			
	- 0.59	M1 A1 A1	3	Using $\tan^{-1} b/a$, or equivalent trig allow + or - Obtain 0.59 Obtain correct answer
	(b)			
	1 – 2i	M1 A1A1 A1	4	Express LHS in Cartesian form & equate real and imaginary parts Obtain $x = 1$ and $y = -2$ Correct answer written as a complex number
	(c)	B1 B1	2	Sketch of vertical straight line Through (- 0.5, 0)
			10	
8.	(i) $\begin{pmatrix}0\\0\end{pmatrix}$ $\begin{pmatrix}2\\0\end{pmatrix}$ $\begin{pmatrix}2\\-2\end{pmatrix}$ $\begin{pmatrix}0\\-2\end{pmatrix}$	B1 B1 B1	3	For correct vertex (2, -2) For all vertices correct For correct diagram
	(ii) Either $\begin{pmatrix}1&0\\0&-1\end{pmatrix}$	B1,B1 B1		Reflection, in x-axis Correct matrix
	$\begin{pmatrix}2&0\\0&2\end{pmatrix}$	B1,B1 B1	6	Enlargement, centre O s.f.2 Correct matrix
	Or $\begin{pmatrix}-1&0\\0&1\end{pmatrix}$	B1,B1 B1		Reflection, in the y-axis Correct matrix
	$\begin{pmatrix}-2&0\\0&-2\end{pmatrix}$	B1,B1 B1		Enlargement, centre O s.f. –2 Correct matrix
	Or $\begin{pmatrix}2&0\\0&1\end{pmatrix}$	B1,B1 B1		Stretch, in x-direction s.f. 2 Correct matrix
	$\begin{pmatrix}1&0\\0&-2\end{pmatrix}$	B1,B1 B1		Stretch, in y-direction s.f. -2 Correct matrix
			9	

9.	(i) $\frac{r+2-r}{r(r+2)}$ $\frac{2}{r(r+2)}$ **AG**	M1 A1	 2	Show correct process for subtracting fractions Obtain given answer correctly
	(ii) $\frac{3}{2} - \frac{1}{n+1} - \frac{1}{n+2}$	M1 M1 A1 A1	 5	Express terms as differences using (i) Express 1st 3 (or last 3) terms so that cancelling occurs Obtain $1 + \frac{1}{2}$ Obtain $-\frac{1}{n+2}, -\frac{1}{n+1}$ Obtain correct answer in any form
	(iii) (a) $\frac{3}{2}$	B1ft	1	Obtain value from their sum to n terms
	(b) $\frac{1}{n+1} + \frac{1}{n+2}$	M1 A1 ft	 2	Using (iii) (a) – (ii) or method of differences again [$n \to \infty$ is a method error] Obtain answer in any form
			10	
10.	(i) $\alpha + \beta + \gamma = 9$	B1	1	
	(ii) $p = \frac{9-\alpha}{2}$	B1 M1 A1 A1	 4	State or use other root is p - iq Substitute into (i) Obtain $2p + \alpha = 9$ Obtain correct answer a.e.f.
	(iii) $\alpha\beta\gamma = 29$	B1	1	
	(iv) $\alpha(p^2 + q^2) = 29$	M1 A1ft	 	Substitute into (iii) Obtain unsimplified expression with no i's
	$q = \sqrt{\frac{29}{\alpha} - \frac{(9-\alpha)^2}{4}}$	M1 M1 A1	 5	Rearrange to obtain q or q^2 Substitute their expression for p a.e.f. Obtain correct answer a.e.f.
			11	
	(iv) Alternative method $2p\alpha + p^2 + q^2 = 27$	M1 A1	 	Substitute into $\alpha\beta + \beta\gamma + \gamma\alpha = 27$ Obtain unsimplified expression with no i's
	$q = \sqrt{27 - \frac{(9-\alpha)^2}{4} - \alpha(9-\alpha)}$	M1 M1 A1	 	Rearrange to obtain q or q^2 Substitute their expression for p a.e.f. Obtain correct answer a.e.f.